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(54) **ELECTRICAL DISTRIBUTION CENTER**

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H01R 13/62 (2006.01)
H01R 13/629 (2006.01)

(52) **U.S. Cl.**
CPC ***H01R 13/62961*** (2013.01); ***H01R 13/62977*** (2013.01); *H01R 13/62922* (2013.01); *H01R 2201/26* (2013.01)

(58) **Field of Classification Search**
CPC H01R 13/62938; H01R 13/639
USPC 439/157, 347, 489, 752, 595, 701
See application file for complete search history.

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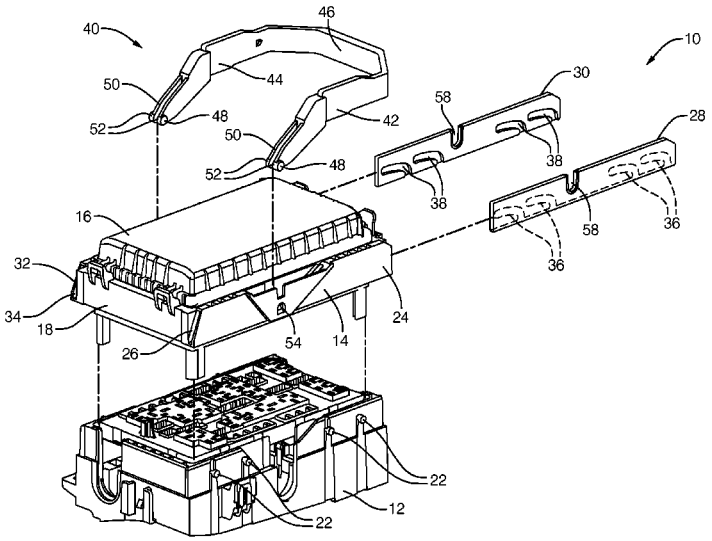
(57) **ABSTRACT**

An electrical distribution center having a base connected to one or several wiring harnesses and a connector body that is configured to be electrically and mechanically connected to the base. The connector body houses electrical devices such as relays, fuses, and control modules. The connector body is secured to the base by a pair of slides having dog-leg shaped slots that engage studs on the base. A single slide lever having two arms attached to each of the slides is pivotably attached to the connector body and the slides and is configured to simultaneously move the dog-leg shaped slots relative to the studs on the base, thereby securing the connector body to the base.

7 Claims, 5 Drawing Sheets



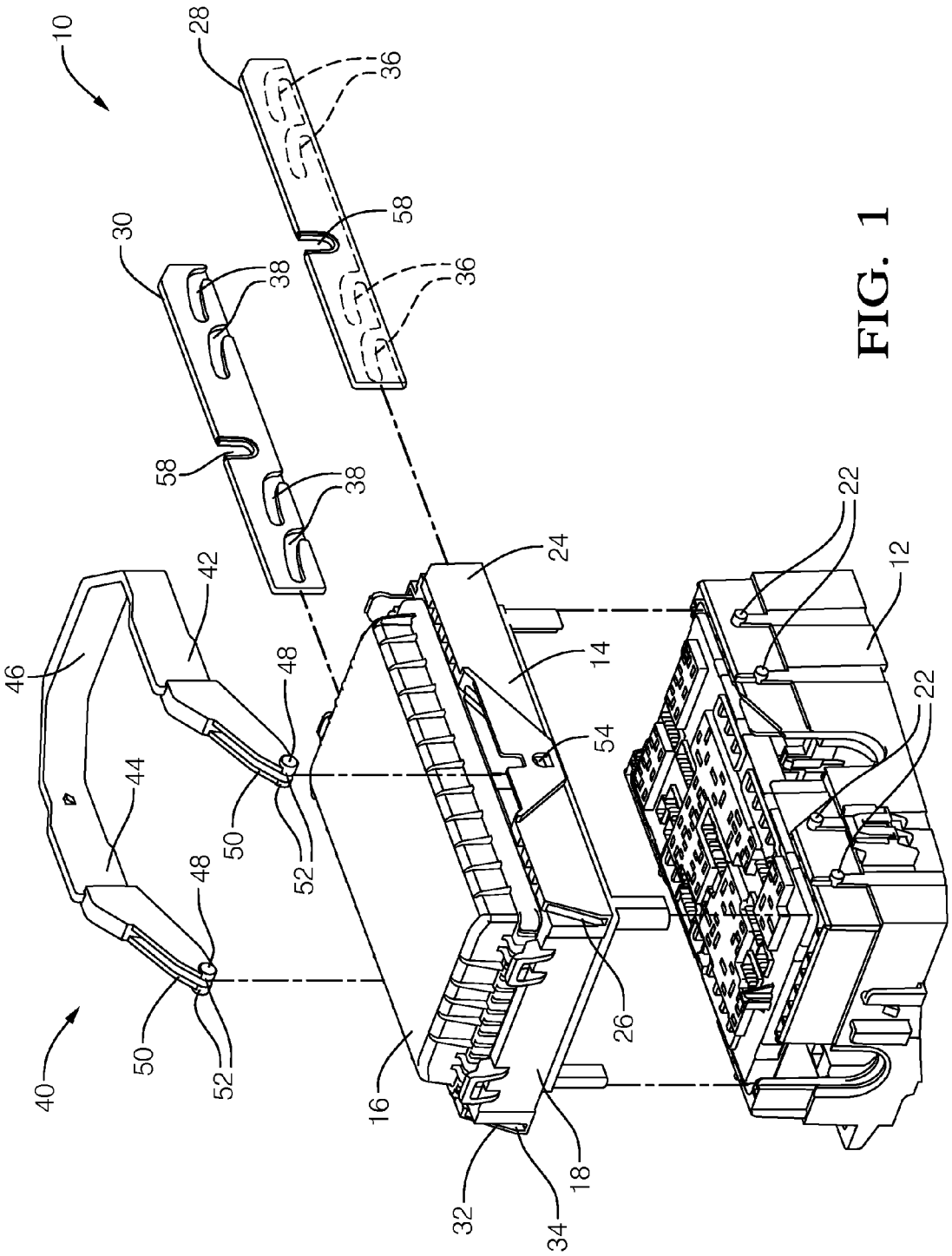

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FIG. 1

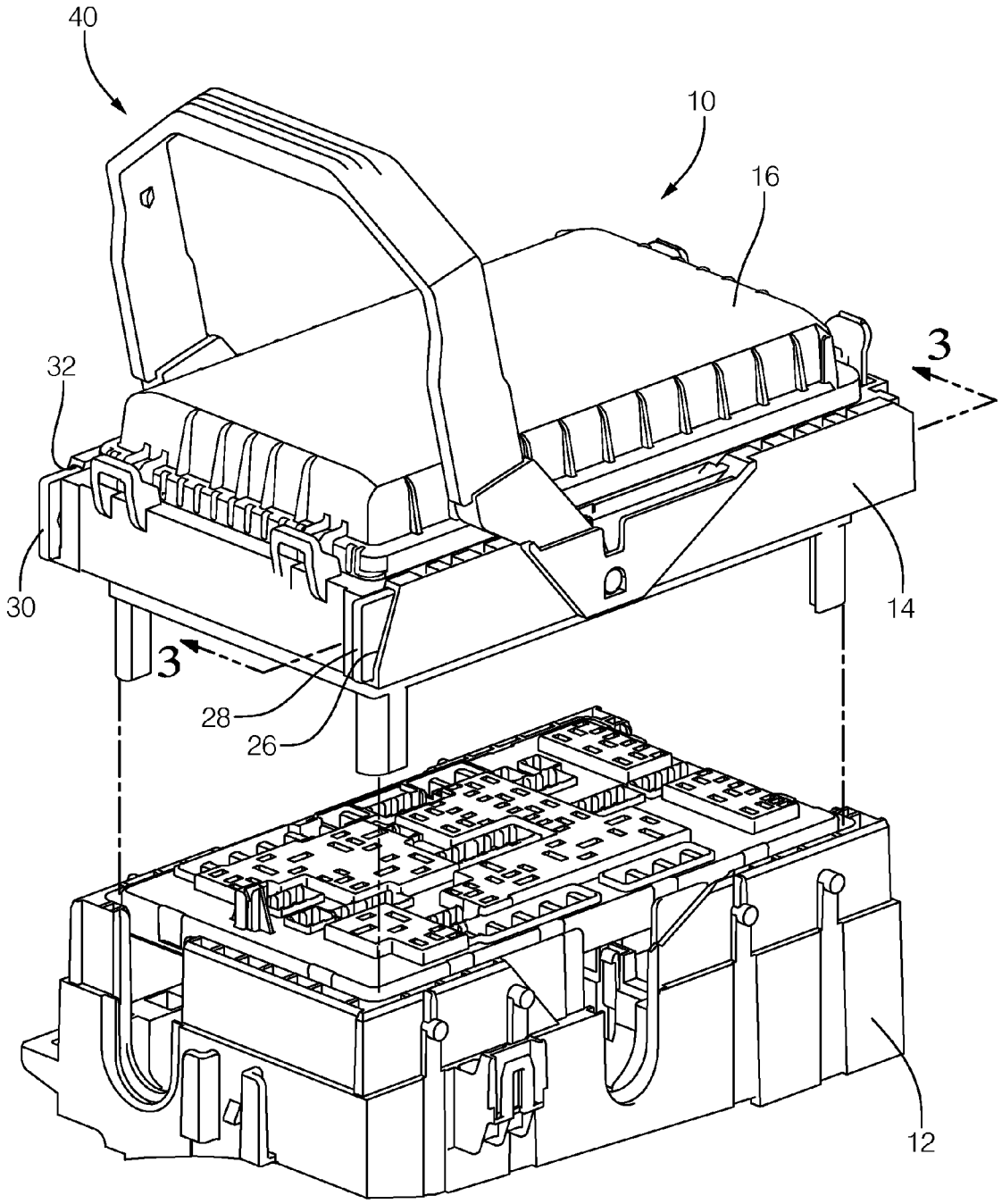

FIG. 2

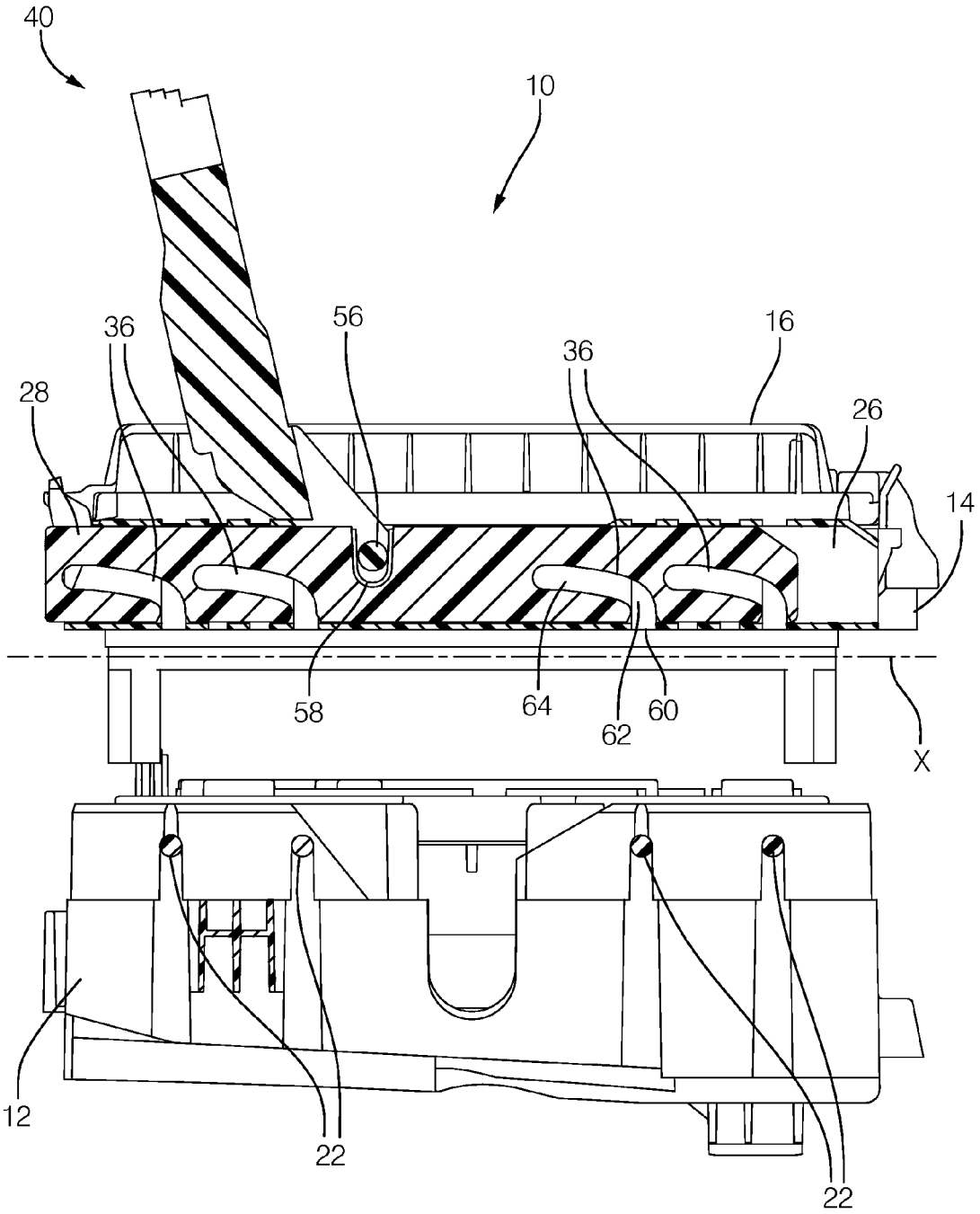

FIG. 3

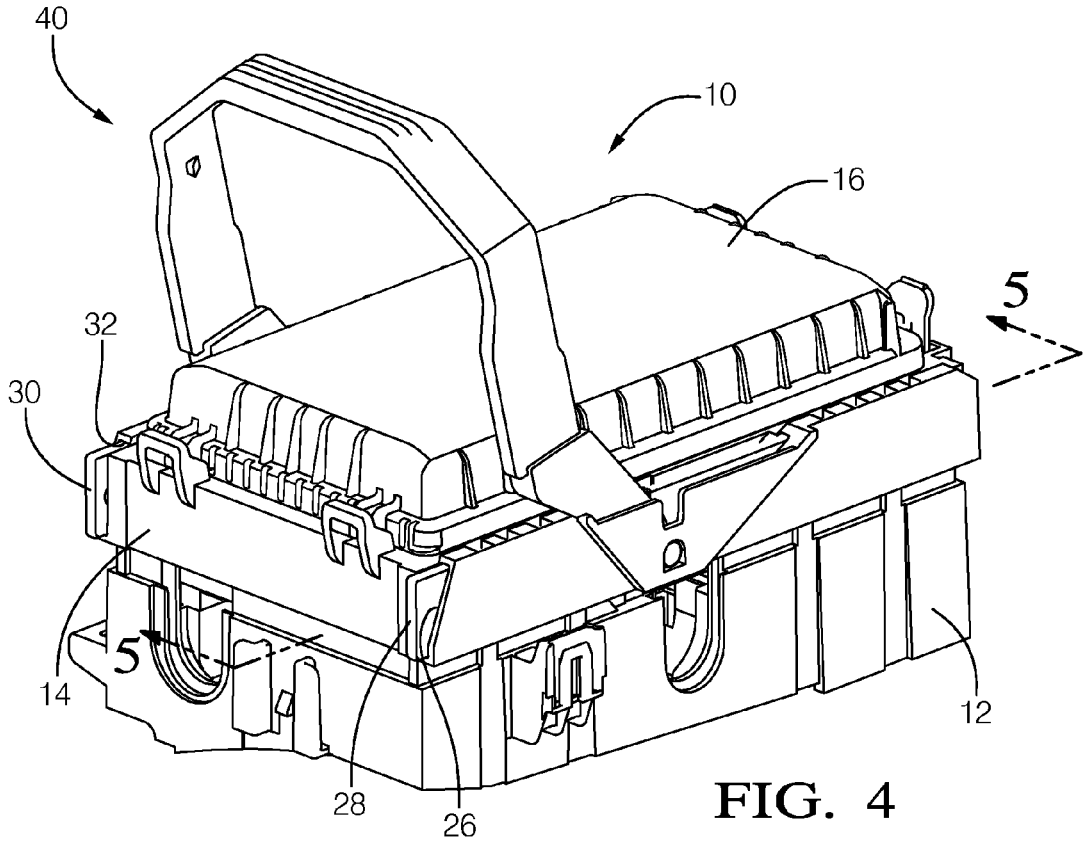

FIG. 4

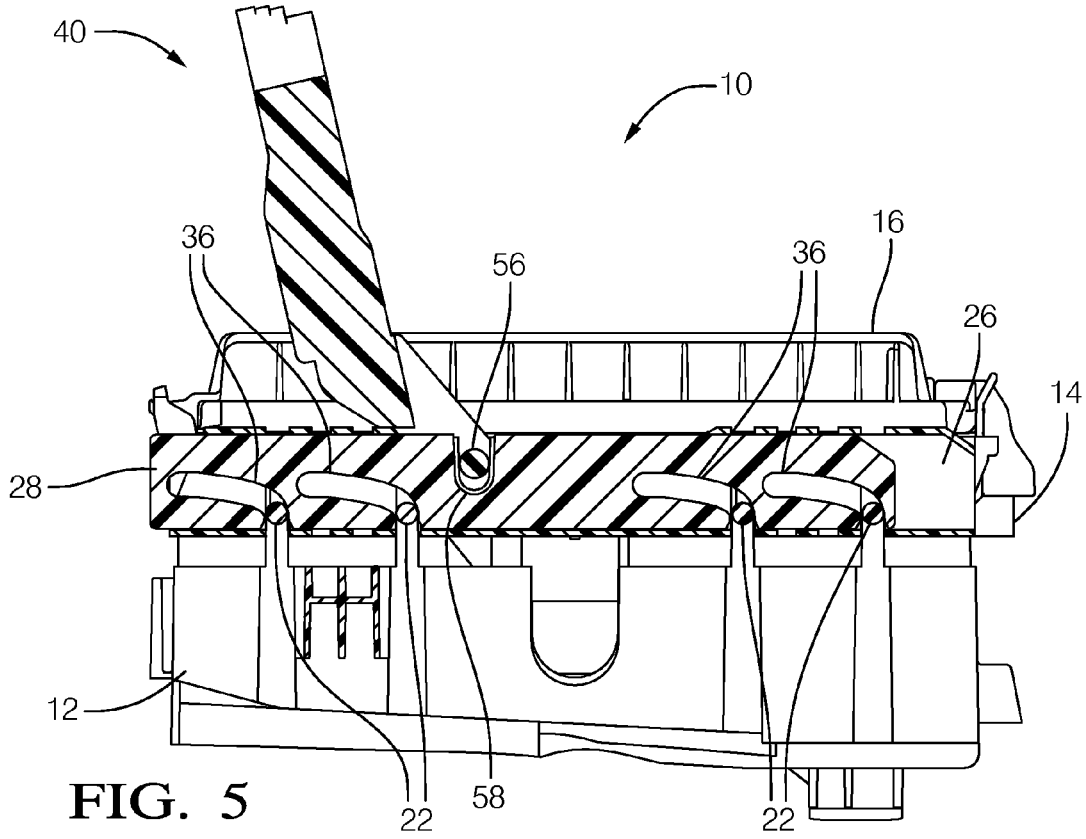

FIG. 5

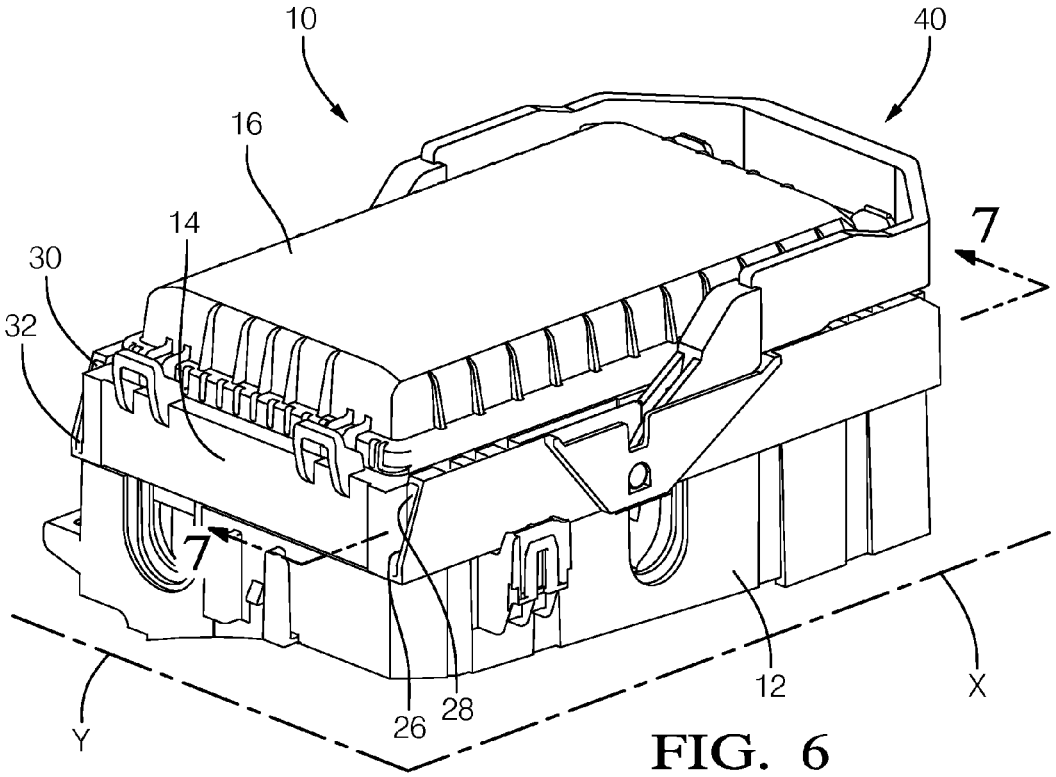
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FIG. 6

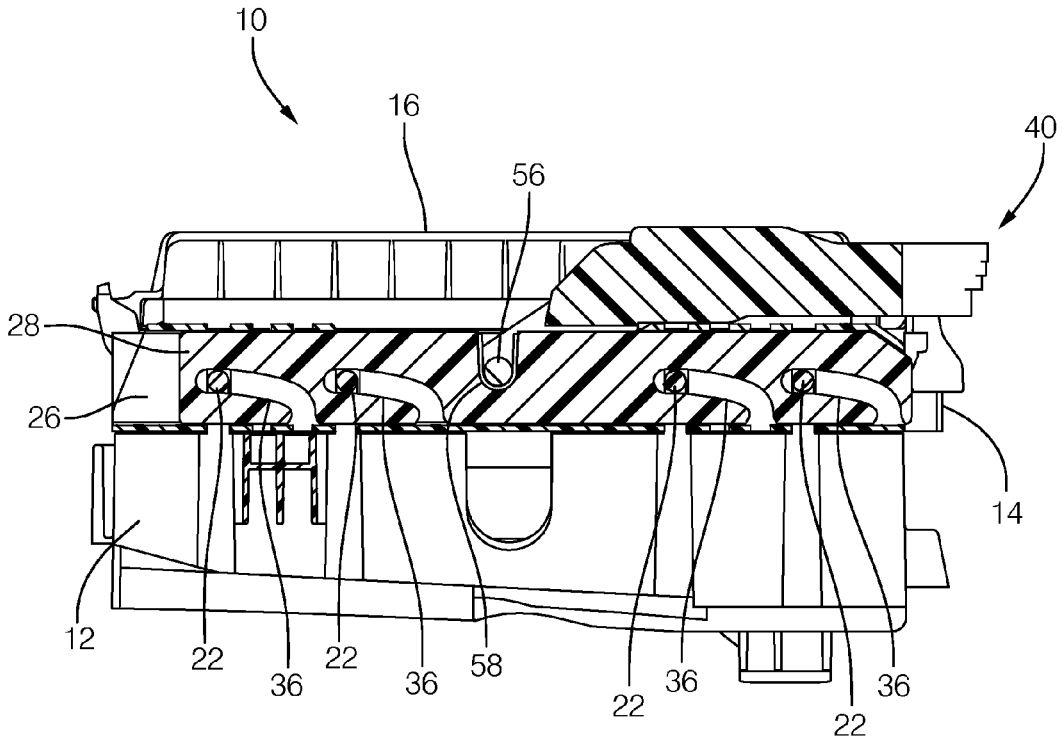
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FIG. 7

ELECTRICAL DISTRIBUTION CENTER

TECHNICAL FIELD OF THE INVENTION

The invention generally relates to electrical distribution center that may be configured for use in a vehicle, and more particularly relates to an electrical distribution center having a plurality of slides and a single lever configured to secure a connector body to a base.

BACKGROUND OF THE INVENTION

Electrical connector assemblies, such as a simple electrical connector or a multi-functional electrical distribution center, are widely used. The electrical distribution centers are generally a central junction box or block system designed as a stand-alone assembly. The electrical connectors typically electrically connect at least two wire harnesses together and thus house a plurality of connected male and female terminals. The distribution centers perform a similar function as the electrical connectors, but may also house various fuses, relays and other electrical devices in a central location. Electrical distribution centers not only reduce cost by consolidating various functions and/or electrical connections into one block, but the centers also reduce the number of cut and spliced leads which increases reliability. Such electrical distribution centers include provisions for electrically connecting a power source and electrical devices housed in the junction block to electrical wiring harness connectors for supplying power and control signals to various electrical systems.

In many electrical distribution center applications, such as that used in the engine compartment of a vehicle, disclosed in U.S. Pat. No. 5,715,135, to Brussalis, the entire disclosure of which is hereby incorporated by reference, devices such as fuses and relays of the electrical distribution centers are accessible from the top with bases protruding from a bottom side. Unfortunately, due to this orientation, access to the connectors is often difficult for mating (connecting) and unmating (disconnecting). In many cases, the electrical distribution center has to be flipped upside down, the connectors assembled, and the entire assembly with protruding wire harnesses flipped again into a final position.

Known electrical distribution centers, such as that disclosed in Brussalis, typically mount the fuses, relays and electrical devices to a top side of an upper electrical distribution panel. A plurality of double ended terminals is engaged to and extends through a tray located below the panel. A top end of each terminal projects through a respective slot of the upper panel for engagement to the fuse, relay or electrical device. A bottom end of the male terminal projects downward through respective slots of yet a second lower tray for electrical engagement to terminals locked into at least one electrical connector body which is engaged to a lower support structure of the distribution center. Unfortunately, the panel, trays and connector bodies are all held together by a plurality of threaded fasteners which is costly to manufacture and requires special tools for assembly and maintenance purposes.

Known improvements to this conventional distribution assembly are described in U.S. Pat. No. 5,788,529 to Borzi issued 4 Aug. 1988, U.S. Pat. No. 6,739,889, to Daggett, issued 25 May 2004, and U.S. Pat. No. 7,094,081 to Senk, et al. issued 22 Aug. 2006. In Borzi and Daggett, the distribution assembly is not flipped when assembling internal connectors and does not require the use of threaded fasteners or bolts thus does not need special assembly tools to secure various connector bodies of the distribution assembly together. Instead, an engagement mechanism or leverage device having four independent cam levers applies a normal force when the cam levers are rotated to connect the distribution assembly. Simultaneous rotation of the four levers also produces a moment which is countered by various structural and alignment features incorporated into this known distribution assembly to maintain alignment of the terminals during connecting. In Senk, the engagement mechanism has two independent cam levers that apply a normal force when rotated to connect the distribution assembly.

The subject matter discussed in the background section should not be assumed to be prior art merely as a result of its mention in the background section. Similarly, a problem mentioned in the background section or associated with the subject matter of the background section should not be assumed to have been previously recognized in the prior art. The subject matter in the background section merely represents different approaches, which in and of themselves may also be inventions.

BRIEF SUMMARY OF THE INVENTION

The inventors recognized the problems created by the prior art electrical distribution centers of requiring packaging space to be allocated on both ends of the electrical distribution center for the levers. The inventors also recognized that separate levers on each end of the electrical distribution center restricts where the electrical distribution center can be mounted in the vehicle while meeting ergonomic requirements to operate the levers. The inventors further recognized the potential for misalignment between the connectors or the connector bodies of the electrical distribution center caused when the levers are engaged separately from each other.

Described herein are solutions for an electrical distribution center having a single lever configured to apply a normal force when rotated to connect the electrical distribution center. The single lever is located centrally in the electrical distribution center. The single lever does not require packaging space to be allocated on both ends to accommodate movement of the lever. Because the electrical distribution center has a single lever, the likelihood of misalignment caused by engaging a plurality of levers separately is reduced. The single lever may also be mounted to the electrical distribution center either laterally or longitudinally, providing greater flexibility for mounting locations in the vehicle that can meet ergonomic requirements.

In accordance with one embodiment of this invention, an electrical distribution center configured for use in a motor vehicle is provided. The electrical distribution center includes a connector body, a base, a first and second slide, and a slide lever. The connector body has a first side wall spaced apart from a second side wall and an electrically conductive first terminal that is rigidly engaged to the connector body. The base has an electrically conductive second terminal rigidly engaged to the base. The second terminal is constructed and arranged to electrically connect with the first terminal. The base defines a first stud and a second stud that are constructed and arranged to mechanically connect with the connector body. The base further includes an electrical connector that is configured be attached to a mating connector of a wire harness. The first slide is slideably supported within a first channel that is defined by the first side wall. The first slide is spaced inwardly from the first side wall and defines a first dog-leg shaped slot configured to engage the first stud. The a second slide slideably supported within a second channel defined by the second side wall and spaced inwardly from the second

side wall and defining a second dog-leg shaped slot configured to engage the second stud. The slide lever is pivotally connected to the first and second side walls of the connector body, the first slide, and the second slide. The slide lever has a first arm connected by a handle to a second arm that is spaced apart from the first arm. The first arm extends between the first slide and the first side wall and the second arm extending between the second slide and the second side wall. The slide lever is operable to simultaneously slideably move the first and second dog-leg shaped slots with respect to the first and second stud, thereby connecting the connector body with the base.

The base may include a plurality of first studs and a plurality of second studs. The first slide may include a plurality of first slots and the second slide may include a plurality of second slots.

The connector body may define a rectangular shape that has a major axis and a minor axis. The first and second slides may be disposed substantially parallel to the major axis or the minor axis.

Further features and advantages of the invention will appear more clearly on a reading of the following detailed description of the preferred embodiment of the invention, which is given by way of non-limiting example only and with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING

The present invention will now be described, by way of example with reference to the accompanying drawings, in which:

FIG. **1** is an exploded perspective view of an electrical distribution center in accordance with one embodiment;

FIG. **2** is a perspective view of a connector body the electrical distribution center of FIG. **1** disconnected from a base in accordance with one embodiment;

FIG. **3** is a partial cut-away side view of the electrical distribution center shown in FIG. **2** in accordance with one embodiment;

FIG. **4** is a perspective view of the connector body the electrical distribution center of FIG. **1** connected to the base with a slide lever in an open position in accordance with one embodiment;

FIG. **5** is a partial cut-away side view of the electrical distribution center shown in FIG. **4** in accordance with one embodiment;

FIG. **6** is a perspective view of the connector body the electrical distribution center of FIG. **1** connected to the base with a slide lever in a locked position in accordance with one embodiment; and

FIG. **7** is a partial cut-away side view of the electrical distribution center shown in FIG. **6** in accordance with one embodiment.

DETAILED DESCRIPTION OF THE INVENTION

The electrical distribution center described herein utilizes a single lever to make the connection in the vehicle from the wire harness electrical connectors to the electrical distribution center. It has a single slide lever that drives a pair of slides which engage studs on the base thereby pulling the electrical center downward onto the electrical connectors. This configuration allows the electrical center to be mounted in one of multiple orientations while still maintaining ergonomic requirements for operating the lever.

Referring to the various figures wherein like numerals refer to like elements throughout the several views, the exploded assembly view of FIG. **1** illustrates a non-limiting example of an electrical distribution center **10**. The electrical distribution center **10** includes a base **12**, a connector body **14**, and a cover **16** attached to the connector body **14**. The cover **16** is configured for covering and protecting relays, fuses, and control modules (not shown) within the connector body **14**. The cover **16** attaches to the connector body **14** by means of several locking tangs **18** that lock the cover **16** to the connector body **14**.

The base **12** includes an electrical connector (not shown) that is configured be attached to a mating connector (not shown) of a wire harness (not shown). The electrical connector also includes electrical terminals (not shown) that are configured to engage electrical terminals (not shown) included in the connector body **14**. The base **12** defines an unthreaded first stud **22** and a corresponding unthreaded second stud on the opposite side of the base **12** (not shown due to the perspective of the drawing). Each stud **22** may be characterized as a boss or cylindrical protuberance extending from the sides of the base **12**. The base **12** may define a plurality of first studs **22** and a plurality of second studs. The connector body **14** is configured to connect with the base **12**, thus establishing electrical connection between the electrical terminals in the connector body **14** and the electrical terminals in the base **12**.

The connector body **14** includes a first side wall **24** spaced apart from the connector body **14** and defining a first channel **26** between the connector body **14** and the first side wall **24**. A first slide **28** is inserted into the first channel **26** and is slidably supported in the first channel **26** and is spaced inwardly from the first side wall **24**. The connector body **14** also includes a second slide **30** that is similarly slidably supported in a second channel **32** defined between a second side wall **34** and the connector body **14** on the opposite side of the connector body **14** from the first side wall **24**. The second slide **30** is spaced inwardly from the second side wall **34**. The first and second channels **26**, **32** are molded as part of the connector body **14**. The first and second channels **26**, **32** support the first and second slides **28**, **30** respectively, but in a position spaced away from the first and second side walls **24**, **34** respectively of the connector body **14**.

The first slide **28** includes a first dog-legged shaped connecting slot **36** that is adapted to receive the first stud **22** of the base **12**. The second slide **30** also includes a second dog-legged shaped connecting slot **38** that is adapted to receive the second stud of the base **12**. A slide lever **40** is pivotally interconnected with the connector body **14** and each of the first and second slides **28**, **30**, and is operable to move the first and second slides **28**, **30**, with respect to the connector body **14** to facilitate connecting the connector body **14** with the base **12**.

The slide lever **40** has a first arm **42** and a spaced apart second arm **44** attached to a central handle portion **46** that is configured to be gripped by an operator. The free ends **48** of the first and second arm **42**, **44**, that is the ends not attached to the central handle portion **46**, define a forked shape having an arm slot **50** between the tines of the fork shape. The first and second slides **28**, **30** are disposed in the arm slots **50** of the first and second arms **42**, **44** respectively. The free ends **48** of the first arm **42** and the second arm **44** each defines a pair of pivot pins **52** that pivotally engage an opening **54** in the first and second side walls **24**, **34** and an opening in the side of the connector body (not shown). The pivot pins **52** and the openings in the connector body **14** allow the slide lever **40** to pivot in relation to the connector body **14**. Each pivot pin **52** may be

substantially equidistant from each end of each side wall **24**, **34**. As used herein, substantially equidistant means±10 millimeters of absolutely equidistant.

FIG. **2** illustrates the electrical distribution center **10** in an assembled condition with the slide lever **40** in the open position. With the slide lever **40** in the open position, a portion of the first and second slides **28**, **30** protrude from the first and second channels **26**, **32**.

FIG. **3** illustrates a partial cutaway view of the electrical distribution center **10** as illustrated in FIG. **2** wherein the first side wall **24** and the outside tine of the first arm **42** are removed. As shown in FIG. **3**, the first arm **42** defines a slide pin **56**. The slide pin **56** has a tapered surface to facilitate engagement with the first slide **28** during assembly. The first slide **28** defines U-shaped slide pin slot **58** that is sized to receive the heads of the pivot pins **52**. Without subscribing to any particular theory of operation, the slide pin **56** interfaces with the slide pin slot **58** so that as the lever pivots about the pivot pin, the slide pin **56** pushes the first slide **28** longitudinally, that is along the longitudinal axis X, within the first channel **26**. The second arm **44** likewise defines a similar slide pin that interfaces with a similar U-shaped slide pin slot to push the second slide **30** longitudinally within the second channel **32**. The slide lever **40** and first and second slides **28**, **30** are configured so that the first and second slides **28**, **30** move substantially simultaneously within the first and second channels **26**, **32**. As used herein, substantially simultaneously means that the first and second slides begin and end movement within 250 milliseconds of each other and the movement of one slide is within ±5 millimeters of the other. As can be best seen in FIG. **3**, the first connecting slot **36** defines a dog-leg shape that has an open end **60** or mouth that is configured to allow entry of the first stud **22** into the first connecting slot **36** when the connector body **14** is mated to the base **12**. The first connecting slot **36** defines a "knee" **62** whereat the slot curves to a closed end **64** wherein the first stud **22** is retained when the first slide **28** is moved by the slide lever **40** to the locked position. The axis of the closed end **64** of the slot defines an angle relative to the open end **60** of the slot that is generally greater than 90 degrees and preferably about 106 degrees.

FIG. **4** illustrates an example of the electrical distribution center **10** wherein the connector body **14** is placed on the base **12** and the slide lever **40** is in the open position.

FIG. **5** illustrates a partial cutaway view of the electrical distribution center **10** as illustrated in FIG. **4** wherein the first side wall **24** and the outside tine of the first arm **42** are removed. As shown in FIG. **5**, each of the first studs **22** is at a beginning point in the open end **60** of each of the first connecting slots **36**. As the first slide **28** moves, it draws the first stud **22** from a beginning point at the mouth of the slot to an ending point at or near the opposite end of the first connecting slot **36**. This action, which is essentially a camming action, draws the base **12** tighter against the connector body **14** and retains it in this tight relationship.

FIG. **6** illustrates an example of the electrical distribution center **10** wherein the slide lever **40** is in a closed position and the connector body **14** is tightly secured to the base **12**. As shown the non-limiting example of FIG. **6**, the slide lever **40** has moved the first and second slides **28**, **30** so that they no longer protrude from the first and second channels **26**, **32**.

FIG. **7** illustrates a partial cutaway view of the electrical distribution center **10** as illustrated in FIG. **5** wherein the first side wall **24** and the outside tine of the first arm **42** are removed. As shown in FIG. **7**, each of the first studs **22** is at an ending point in the closed end **64** of each of the first connecting slots **36** after the slide lever **40** has moved the first slide **28** relative to the first studs **22**.

The second slide **30**, second stud, and second arm **44** contain all of the features of the first slide **28**, first stud **22**, and first arm **42** illustrated in FIGS. **3**, **5**, and **7**. The second slide **30** functions similarly and substantially simultaneously with the first slide **28**.

The first and second arms **42**, **44** each terminate in a tip segment. The first and second arms **42**, **44** each include an abutment disposed adjacent the tip segment, wherein the abutment extends outwardly from the tip segment relative to an imaginary axis running the length of each arm. In other words, the tip segment is narrower than the portion of the arm having the abutment.

Each channel defines a support slot that is sized to provide clearance to the tip segment, but not the abutment, so that the tip segment passes through the support slot until the abutment abuts the channel. The support slot may be viewed as an interruption in the channel.

The connector body **14** defines a deflection slot adjacent the support slot. The deflection slot is contiguous with the support slot. The purpose of the deflection slot is to allow the side walls of the connector body **14** to deflect outwardly when the slide lever **40** is connected to the first and second slides **28**, **30** during assembly.

The electrical distribution center **10** may define a rectangular shape having a major axis and a minor axis. The first and second slides **28**, **30** may be disposed substantially parallel to the major axis X (longitudinally) or alternatively may be disposed substantially parallel to the minor axis Y (laterally). As used herein, substantially parallel is ±15° of absolutely parallel. Thus, being able to mount the slides laterally or longitudinally may provide greater flexibility for finding mounting locations in the vehicle for the electrical distribution center **10** that can meet ergonomic requirements for an operator operating the slide lever **40**.

The component pieces of the electrical distribution center **10** including the connector body **14**, base **12**, first and second slides **28**, **30**, and slide lever **40** are made from a suitable injection molded plastic, such as polyamide (PA, NYLON), polybutylene terephthalate (PBT), or polypropylene (PP).

Accordingly, an electrical distribution center **10** is provided. The connector body **14** may be attached to the base **12** of the electrical distribution center **10** by operating a single slide lever **40**. The single slide lever **40** does not require packaging space to be allocated on both ends of the electrical distribution center **10** to accommodate movement of the slide lever **40**. Because the electrical distribution center **10** has a single slide lever **40**, the likelihood of misalignment caused by engaging a plurality of levers separately is reduced. The single slide lever **40** may also be mounted to the electrical distribution center **10** either laterally or longitudinally, providing greater flexibility for mounting locations in the vehicle that can meet ergonomic requirements.

While this invention has been described in terms of the preferred embodiments thereof, it is not intended to be so limited, but rather only to the extent set forth in the claims that follow. Moreover, the use of the terms first, second, etc. does not denote any order of importance, but rather the terms first, second, etc. are used to distinguish one element from another. Furthermore, the use of the terms a, an, etc. do not denote a limitation of quantity, but rather denote the presence of at least one of the referenced items.

We claim:

1. An electrical apparatus configured for use in a motor vehicle, comprising:

a connector body having a first side wall spaced apart from a second side wall and an electrically conductive first terminal rigidly engaged to the connector body;

a base having an electrically conductive second terminal rigidly engaged to the base and constructed and arranged to electrically connect with the first terminal defining a first stud and a second stud constructed and arranged to mechanically connect with the connector body, said base further including an electrical connector configured be attached to a mating connector of a wire harness;

a first slide slideably supported within a first channel defined by the first side wall and spaced inwardly from the first side wall, the first slide defining a first dog-leg shaped slot configured to engage the first stud;

a second slide slideably supported within a second channel defined by the second side wall and spaced inwardly from the second side wall, the second slide defining a second dog-leg shaped slot configured to engage the second stud; and

a slide lever pivotally connected to the connector body, the first slide, and the second slide, the slide lever having a first arm connected by a handle to a second arm spaced apart from the first arm, wherein the first arm defines a fork shape having a first arm slot and the second arm defines a fork shape having a second arm slot, wherein the first slide is disposed within the first arm slot and the second slide is disposed within the second arm slot, and wherein the slide lever is operable to simultaneously slideably move the first and second dog-leg shaped slots with respect to the first and second stud, thereby connecting the connector body with the base.

2. The apparatus according to claim **1**, wherein the first arm is pivotally connected to a central portion of the first side wall and the second arm is pivotally connected to a central portion of the second side wall.

3. The apparatus according to claim **2**, wherein the connector body defines a rectangular shape having a major axis and a minor axis and wherein the first and second slides are disposed substantially parallel to the major axis.

4. The apparatus according to claim **2**, wherein the connector body defines a rectangular shape having a major axis-and a minor axis and wherein the first and second slides are disposed substantially parallel to the minor axis.

5. The apparatus according to claim **2**, wherein an open end of the first dog-leg shaped slot defines about a 74 degree angle with a closed end of the first dog-leg shaped slot.

6. The apparatus according to claim **2**, wherein the connector body includes a first pivot pin extending from the first side wall and engaging the first arm and a second pivot pin extending from the second side wall and engaging the second arm.

7. The apparatus according to claim **6**, wherein each pivot pin is substantially equidistant from each end of each side wall.

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